

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claims 1-9. (canceled).

Claim 10. (currently amended) A method for data rate matching, the method comprising the steps of:

distributing data to be transmitted in the form of bits via a first interleaver to a set of K frames;

carrying out a puncturing or repetition method for data rate matching after interleaving; and

varying a distance between punctured or repeated bits with regard to the sequence of the bits before the first interleaver, for puncturing or repeating the same number of bits in each frame, with the separation being defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q,K) + 1$ , where mean puncturing distance is

$q := (\lfloor N_c / (|N_i - N_c|) \rfloor) \bmod K$ , where  $\lfloor \rfloor$  refers to rounding down and  $||$  refers to absolute value, and where  $N_i$  := the number of bits after rate matching,  $N_c$  := the number of bits before rate matching; and

$\text{lcd}(q, K) :=$  highest common denominator of q and K,

wherein a puncturing or repetition process is carried out in such a manner that the puncturing or repetition pattern used within a frame is also shifted and used within further frames in the set of frames, and wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver are obtained by a method which comprises the steps of:

puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q;

varying the distance to q-1 or q+1 between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q; and

continuing with the step of puncturing if any further bits need to be punctured or repeated.

Claim 11. (currently amended) A method for data rate matching as claimed in claim 10, wherein

the following relationship is also valid when the puncturing rate or the repetition rate is equal to  $1/K$ :

$q-1 \leq \text{distance} \leq q + \text{lcd}(q,K) + 1$ , where mean puncturing distance is

$q := (\lfloor N_c / (\lfloor N_i - N_c \rfloor) \rfloor) \bmod K$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $||$  refers to absolute value, and where  $N_i :=$  the number of bits after rate matching,  $N_c :=$  the number of bits before rate matching; and

$\text{lcd}(q, K) :=$  highest common denominator of  $q$  and  $K$ .

Claim 12. (canceled).

Claim 13. (canceled)

Claim 14. (previously presented) A method for data rate matching as claimed in claim 10, wherein the shift  $V(k) = S(k) + T(k) * Q$  in the use of the puncturing or repetition pattern to the frame  $k$  can be produced via the steps of:

calculating a mean puncturing distance  $q = \lfloor N_e / (\lfloor N_i - N_o \rfloor) \rfloor \bmod K$ , in which case:  $q := (\lfloor N_e / (\lfloor N_i - N_o \rfloor) \rfloor) \bmod K$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $|\cdot|$  refers to absolute value, and in which case:

$N_i$  := the number of bits after rate matching, and

$N_o$  := the number of bits before rate matching;

calculating  $Q$ , in which case:  $Q := ((\lfloor N_e / (\lfloor N_i - N_o \rfloor) \rfloor) \bmod K)$ ;

if  $q$  is even, then  $q$  is set to  $q - \text{lcd}(q, K)/K$  where  $\text{lcd}(q, K)$  := the highest common denominator of  $q$  and  $K$ ; - a variable  $i$  is set to zero; and

repeating the following steps as long as  $i \leq K-1$ :

$S(R_K(\lceil i * q \rceil \bmod K)) = \lceil i * q \rceil \bmod K$ , where  $\lceil \cdot \rceil$  refers to rounding;

$T((R_K(\lceil i * q \rceil \bmod K)) = i$ , where  $R_K(k)$  reverses the interleaver; and

$i$  becomes  $i + 1$ .

Claim 15. (previously presented) A method for data rate matching as claimed in claim 10, wherein the shift  $V(k) = S(k)$  of the use of the puncturing and repetition pattern to the frame  $k$  can be produced via the steps of:

calculating a mean puncturing distance  $q$ , in which case:

$q := \lfloor N_o / (\lfloor N_i - N_o \rfloor) \rfloor$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $|\cdot|$  refers to absolute value,

and in which case:

$N_i$  := the number of bits after rate matching,

$N_o$  := the number of bits before rate matching; and

if  $q$  is even, then  $q$  is set to  $q - \text{lcd}(q, K)/K$ , where  $\text{lcd}(q, K)$  := the highest common denominator of  $q$  and  $K$ ; - a variable  $i$  is set to zero; and

repeating the following steps as long as  $i \leq K-1$ :

$S(R_K(\lceil i * q \rceil \bmod K)) = \lceil i * q \rceil \text{div } K$ , where  $\lceil \cdot \rceil$  refers to rounding up;

$R_K(k)$ , where  $R_K(k)$  reverses the interleaver; and

$i$  becomes  $i + 1$ .

Claim 16. (previously presented) A method for data rate matching as claimed in claim 10, wherein bits which are to be punctured or to be repeated are produced via a method which comprises the steps of:

determining the integer component  $q$  of the mean puncturing distance using  $q := \lfloor N_o / (\lfloor N_i - N_o \rfloor) \rfloor$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $|\cdot|$  refers to value, and in which case:

$N_i$  := the number of bits after rate matching, and

$N_o$  := the number of bits before rate matching;

selecting a bit to be punctured or to be repeated in a first column;

selecting the next bit to be punctured or to be repeated in the next frame, starting from the last bit to be punctured or to be repeated in the previous frame by selecting the next bit at the distance  $q$ , with respect to the original sequence, starting with this last bit to be punctured

or to be repeated, providing this does not lead to a frame being punctured or repeated twice, or else by selecting a bit with a distance which has been changed from  $q$  to  $q-1$  or  $q+1$  for puncturing or repetition; and

repeating the step of selecting the next bit until all columns have been punctured or repeated once.

Claim 17. (previously presented) A method for data rate matching as claimed in claim 16, wherein bits in a first frame are punctured or repeated in accordance with a predetermined puncturing pattern or repetition pattern, and

in order to select further bits to be punctured or to be repeated, the puncturing pattern or repetition pattern shifted and is applied to further frames, with the shift in the application of the puncturing pattern or repetition pattern to a further frame corresponding to the shift of the bit, chosen in the step of selecting the next bit in the further frame with respect to the bit chosen in the step of selecting a bit.

Claim 18. (currently amended) A data rate matching apparatus, comprising:

means for distributing data to be transmitted in the form of bits via a first interleaver to a set of  $K$  frames;

means for carrying out a puncturing or repetition method for data rate matching after interleaving; and

means for varying a distance between punctured or repeated bits with regard to the sequence of the bits before the first interleaver, for puncturing or repeating the same number of bits in each frame, with the separation being defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q,K) + 1$ , where mean puncturing distance is

$q := (\lfloor N_c / (\lfloor N_i - N_d \rfloor) \rfloor) \bmod K$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $||$

refers to absolute value, and where  $N_i :=$  the number of bits after rate matching,

$N_c :=$  the number of bits before rate matching; and  $\text{lcd}(q, K) :=$  highest common

denominator of  $q$  and  $K$ .

wherein a puncturing or repetition pattern used within a frame in the puncturing or repetition means is also shifted and used within further frames in the set of frames, and wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver are obtained by a part which comprises:

means for puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude  $q$ ;

means for varying the distance to  $q-1$  or  $q+1$  between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude  $q$ ; and

means for continuing with the step of puncturing if any further bits need to be punctured or repeated.

Claim 19. (canceled)

Claim 20. (previously presented) A method for data rate matching, the method comprising the steps of:

distributing data to be transmitted in the form of bits via a first interleaver to a set of K frames;

carrying out a puncturing or repetition method for data rate matching after interleaving; and

varying a distance between punctured or repeated bits with regard to the sequence of the bits before the first interleaver, for puncturing or repeating the same number of bits in each frame, with the separation being defined by the following relationship:

$$q-1 \leq \text{distance} \leq q + \text{lcd}(q, K) + 1, \text{ where}$$

$q := (\lfloor N_c / (\lfloor N_i - N_c \rfloor) \rfloor) \bmod K$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $||$  refers to absolute value, and where  $N_i :=$  the number of bits after rate matching,  $N_c :=$  the number of bits before rate matching; and

$$\text{lcd}(q, K) := \text{highest common denominator of } q \text{ and } K,$$

wherein bits which are to be punctured or to be repeated are produced via a method which comprises the steps of:

determining the integer component q of the mean puncturing distance using  $q := (\lfloor N_c / (\lfloor N_i - N_c \rfloor) \rfloor)$ , where  $\lfloor \cdot \rfloor$  refers to rounding down and  $||$  refers to value, and in which case:

$N_i :=$  the number of bits after rate matching, and

$N_c :=$  the number of bits before rate matching;

selecting a bit to be punctured or to be repeated in a first column;

selecting the next bit to be punctured or to be repeated in the next frame, starting from the last bit to be punctured or to be repeated in the previous frame by selecting the next bit at the

distance  $q$ , with respect to the original sequence, starting with this last bit to be punctured or to be repeated, providing this does not lead to a frame being punctured or repeated twice, or else by selecting a bit with a distance which has been changed from  $q$  to  $q-1$  or  $q+1$  for puncturing or repetition; and

repeating the step of selecting the next bit until all columns have been punctured or repeated once.